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(54) Rolling mill

(57) A rolling mill has its work rolls 2, 3 mounted in bearing chock assemblies 4 which are urged vertically against horizontally extending beams 8, 10 in the mill housings 1, 1A. The rolls and their bearing chock assemblies are slideable axially along the beams and hydraulic rams 14 are provided adjacent the ends of the beams 8, 10 to apply vertical bending forces thereto.

By applying bending forces to the ends of the beams 8, 10 these forces can be transferred to the bearing chock assemblies 4 of the work rolls wherever the bearing chock assemblies are positioned along the length of the beams.

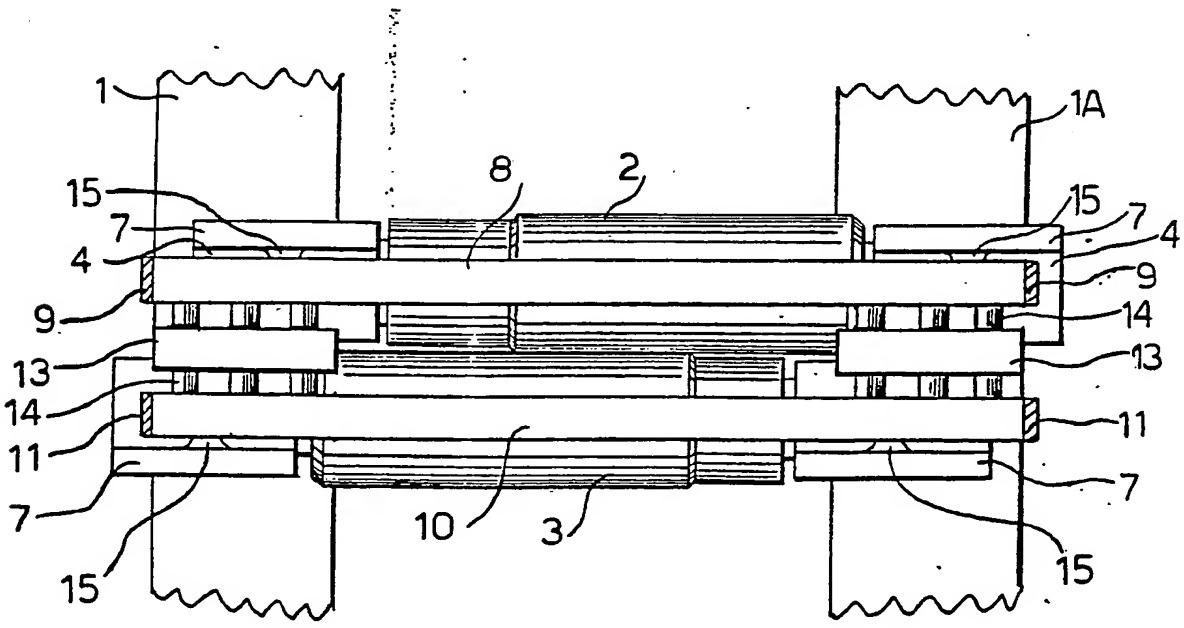

FIG 3

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The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

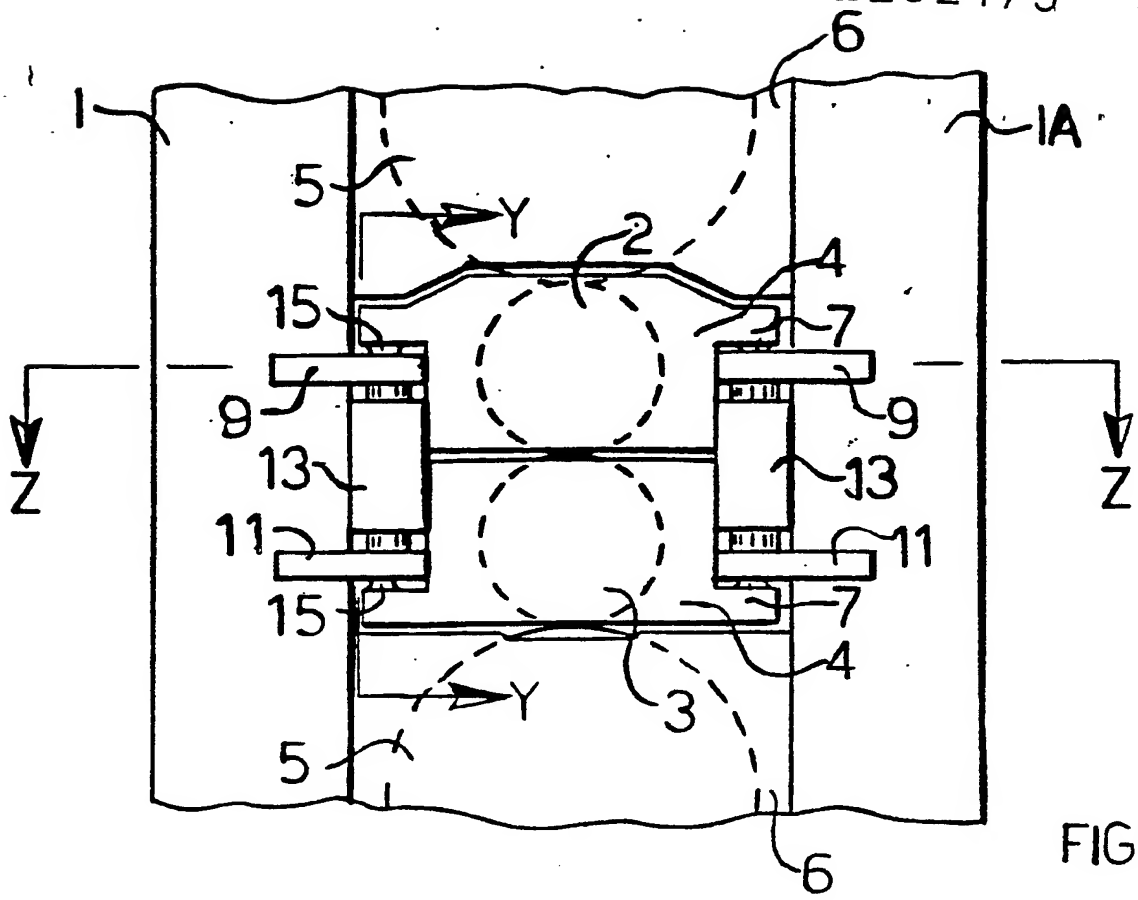
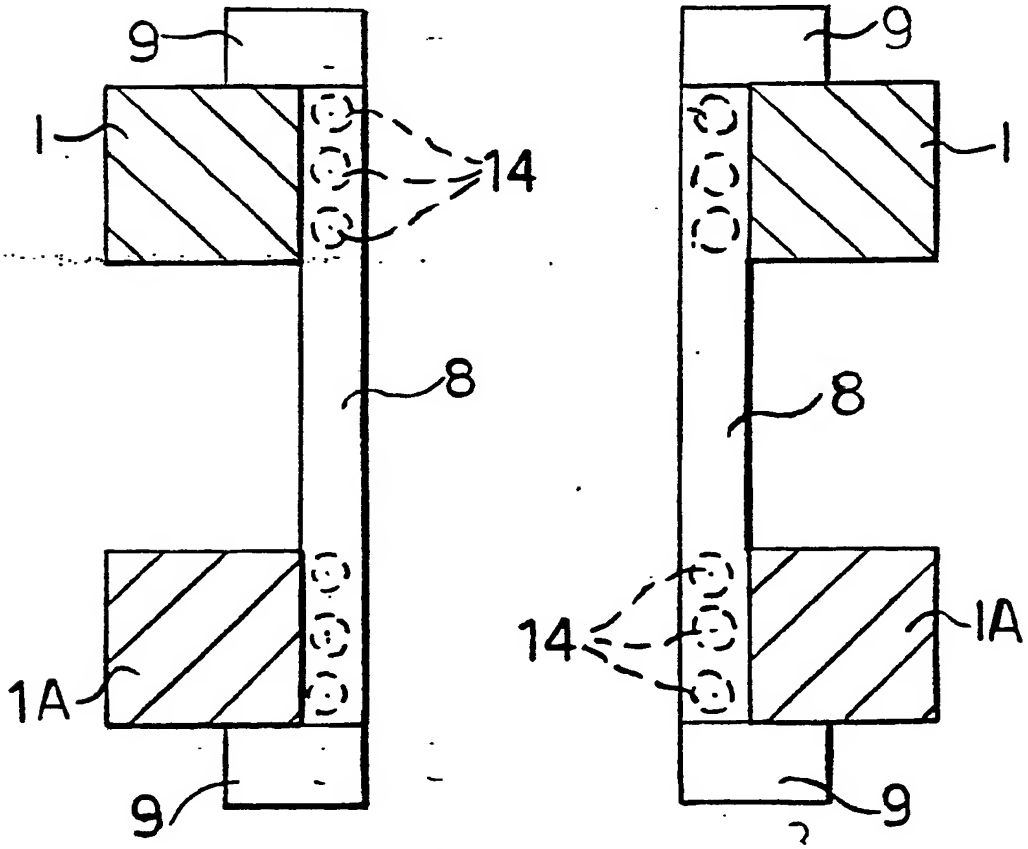


FIG 1



'Z-Z'

FIG.2

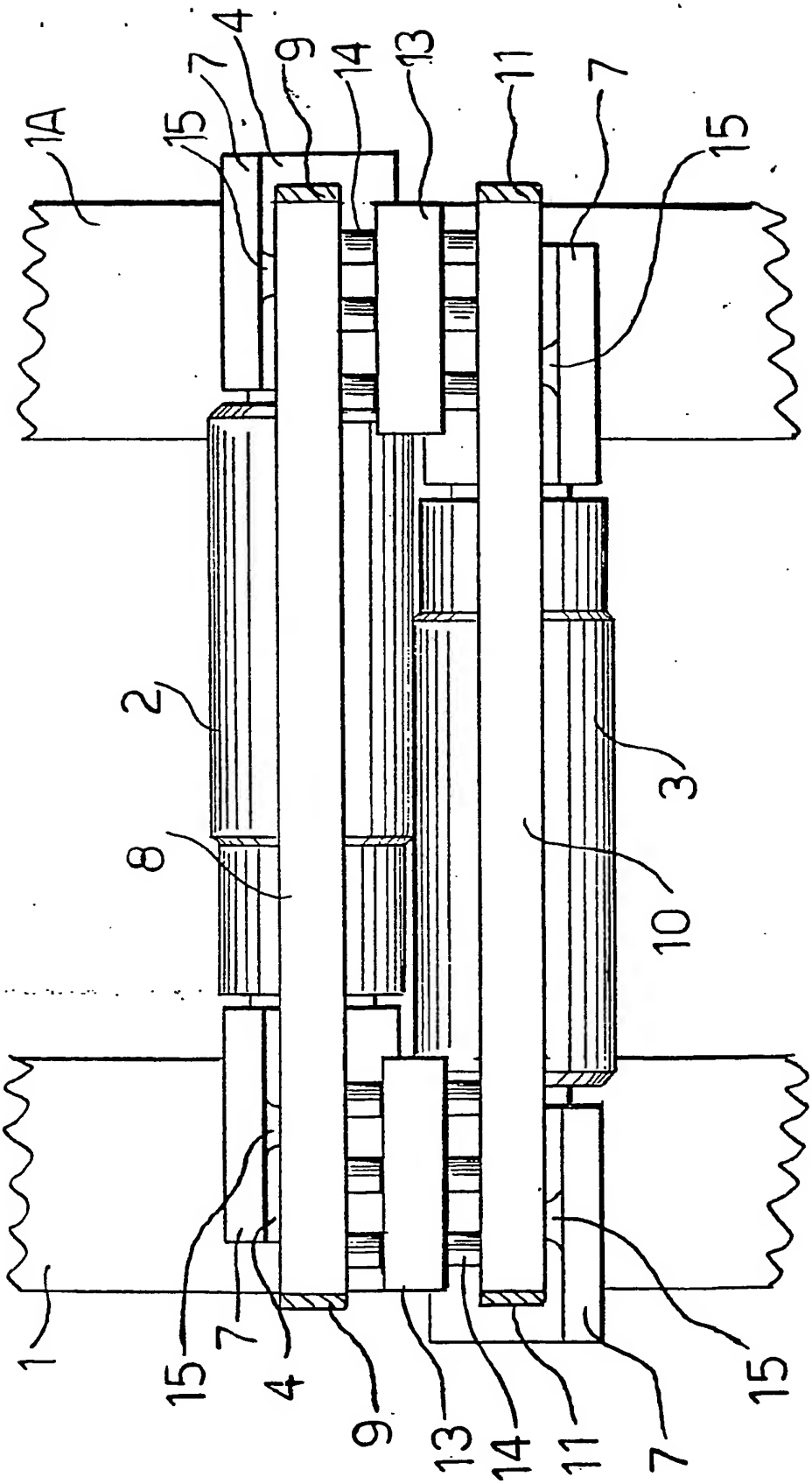


FIG 3

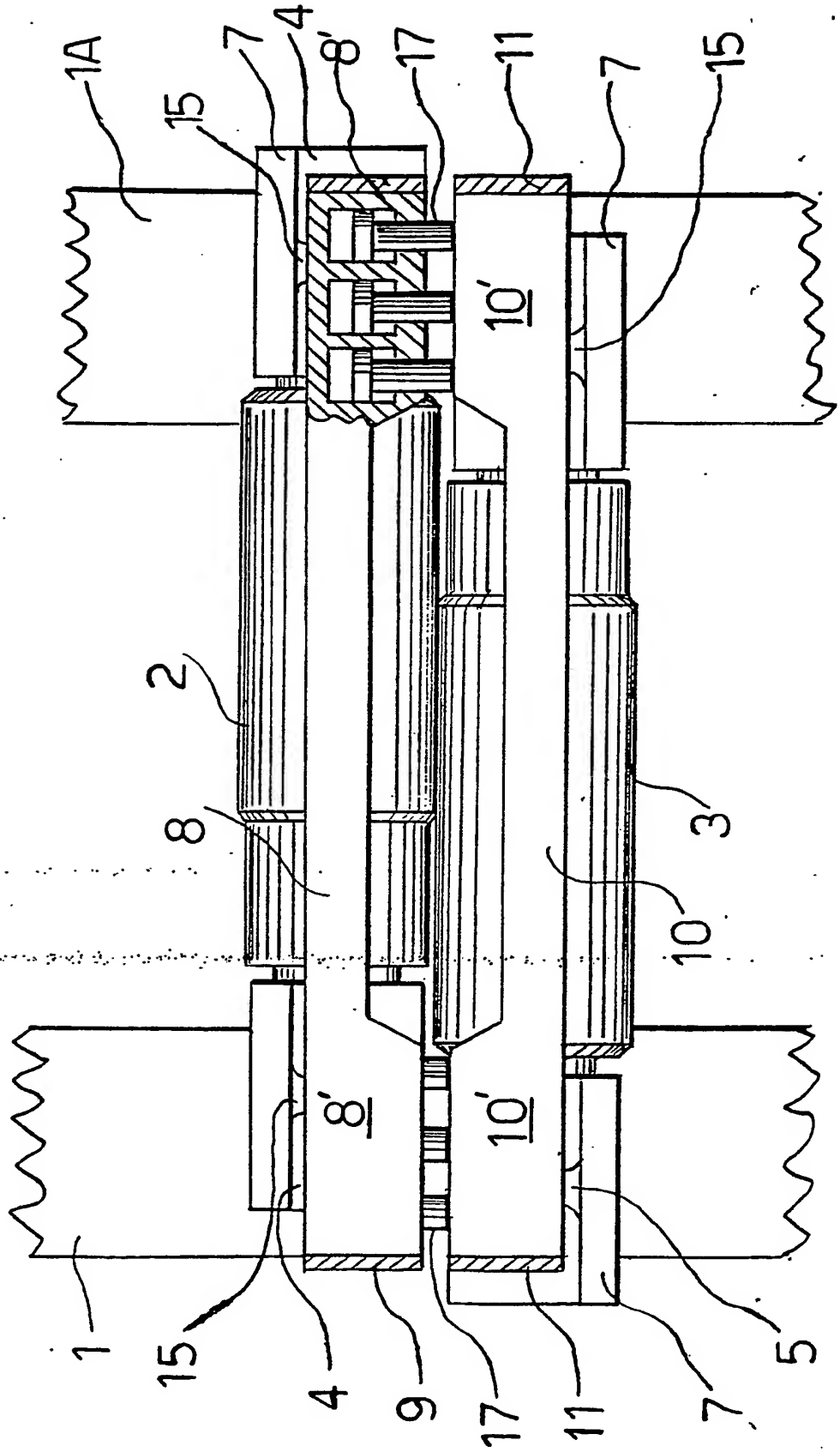


FIG 4

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ROLLING MILL

This invention relates to a rolling mill for rolling metal strip and in particular to a rolling mill having its work rolls displaceable axially in order to be able to improve the shape of the strip which is rolled in the mill.

In order to improve the shape of metal strip rolled in a rolling mill, it is known to be able to axially displace the work rolls and also to apply bending forces to the work rolls.

The ability to axially move the work rolls reduces the unevenness of the wear on the rolls and this brings about an improvement in the surface quality of the strip material which is rolled in the mill.

Roll bending is applied to the work rolls in order to compensate, at least to some extent, for the bending of the work rolls which takes place when the strip material is being rolled.

It is an object of the present invention to provide a mill in which the roll bending and the axial movement of the work rolls can readily be brought about.

According to the present invention, a rolling mill comprises a pair of spaced apart mill housings; an upper work roll and a lower work roll, each

supported at its ends in bearing chock assemblies; means for rotating the rolls; the bearing chock assemblies of the upper work roll being urged vertically against horizontal beams located in the housing; the bearing chock assemblies of the lower work roll being urged vertically against further horizontal beams located in the housing; at least one of the upper and lower work rolls and its bearing chock assemblies being displaceable axially of the roll with respect to the horizontal beams, said beams being displaceable vertically with respect to the housings but being restrained against movement in their axial and lateral directions; and means engagable with the beams adjacent their ends to apply substantially vertical bending forces thereto.

By applying bending forces to the ends of the beams, these forces can be transferred to the bearing chock assemblies of the work rolls wherever the bearing chock assemblies are positioned along the length of the beams.

Furthermore, since the bending means do not engage directly with the bearing chock assemblies, there is no likelihood of damage being caused to the bending means by the bearing chock assemblies when the rolls are moved axially.

In one embodiment of the invention, the

bearing chock assemblies of the upper work roll bear downwardly against a pair of said horizontal beams and the bearing chock assemblies of the lower work roll bear upwardly against a pair of said further horizontal beams, all of said beams extending from one mill housing to the other.

The mill housings are provided with guides which enable the beams to be raised and lowered with respect to the housings but which prevent movement of the beams in their axial and lateral directions.

The bending forces may be applied to the beams by way of hydraulic rams which are mounted on the mill housings. Each hydraulic ram may comprise a cylinder structure mounted on one of the mill housings with a piston extending from the structure and engagable with the beam. In a convenient arrangement, the hydraulic rams comprise a cylinder structure having rams extendable vertically from opposite ends thereof and engagable with one of said beams and one of said further beams, respectively. Alternatively, the hydraulic rams may be located in one of the beams and bear against the other beam.

Each of the work rolls is conveniently backed-up by a separate massive back-up roll.

In an alternative arrangement, there is an intermediate roll between each work roll and its back-

up roll and the intermediate roll and their bearing chock assemblies are displaceable axially.

The upper work roll and the lower work roll may be arranged whereby one roll can be crossed with respect to the other roll. When back-up rolls are provided, each work roll and its back-up roll may be arranged as a unit and the units can be crossed with respect to each other.

In order that the invention may be more readily understood, it will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is an end elevation of part of a rolling mill in accordance with the present invention;

Figure 2 is a section on the line Z-Z of Figure 1 with the mill rolls removed;

Figure 3 is a side elevation on the line Y-Y of Figure 1; and

Figure 4 is a side elevation, similar to Figure 3, showing an alternative embodiment of the invention.

A rolling mill for rolling metal strip, particularly strip steel, comprises a pair of spaced apart mill housings 1, 1A, respectively. A pair of work rolls 2, 3 are supported at their ends in bearing chock assemblies 4. Each work roll is backed-up by a

massive back-up roll 5 and the back-up rolls are supported at their ends in bearing chock assemblies 6.

The bearing chock assemblies 4 of the upper work roll are provided with outwardly extending wings 7 which rest upon a pair of beams 8 which pass through and extend between the mill housings 1, 1A. At each end of each beam there is an outwardly extending wing 9 which fits outside the respective mill housing 1, 1A.

The bearing chock assemblies 4 of the lower work roll 3 also have outwardly extending wings 7 and these wings are urged against the underside of a pair of further beams 10 which pass through and extend between the housings 1, 1A and each beam has an outwardly extending wing 11 which fits around the outside of the posts of the mill housings.

In a manner not shown, the mill housings 1, 1A and the wings 9, 11 have incorporated in them guides which permit the beams 8, 10 to be raised and lowered vertically with respect to the housings but which prevent the beams from being moved laterally and axially.

The bearing chock assemblies 4 of the upper and lower work rolls have limited lateral movement because of the interface between the vertical sides of the beams and the vertical sides of the chocks, but the chocks are permitted to move axially along the beams.

Means (not shown) are provided for driving and rotating the work rolls and also for displacing the work rolls and their bearing chock assemblies in the direction axially of the work rolls with respect to the beams 8, 10.

On the inside of each mill housing 1, 1A there are a pair of hydraulic ram assemblies, each having a cylinder structure 13 which is secured to the housing and having a plurality of rams 14 projecting from its upper and lower ends and the rams act against the underside of the wings 9 of the beams 8 and against the upper side of the wings 11 of the further beams 10. By actuating the rams, substantially vertical bending forces are applied to the ends of the beams and these forces are transmitted from the beams through the bearing chock assemblies to the roll ends wherever the rolls are positioned on the beams.

Figure 3 shows the upper and lower work rolls displaced axially with respect to each other and a plurality of bending rams are shown acting the on the ends of the beams.

The bearing chock assemblies 4 at each end of the work rolls 2, 3 have wear pads 15 fitted to the chock wings 7. These wear pads have a limited area of contact with the beams 8, 10 but ensure that the bending force transitted from the beam to the bearing

chock assembly acts centrally through the roll bearings mounted within the assembly. In practice, the axial movement of the rolls and their bearing chock assemblies is limited so that the wear pads 15 do not move outside of the outer cylinders at the ends of the beams. The wear pads fited to the chock wings can easily be replaced when worn.

An alternative arrangement is shown in Figure 4 where the beams 8, 10 have thickened portions 8', 10' at their ends. The hydraulic ram assemblies, shown in Figures 1 to 3, are replaced by hydraulic ram assemblies 17 mounted within the thickened portions 8' at the ends of the beams 8. The thickened portions define cylinders in which rams are fitted, the rams projecting through openings in the thickened portions and engaging against the adjacent surfaces of the thickened portions at the ends of the further beams 10. When fluid under pressure is applied to the ram assemblies, the rams engage with the beams 10 and apply substantially vertical forces to both the beams 8 and 10.

Claims:

1. A rolling mill comprising

a pair of spaced apart mill housings;

an upper work roll and a lower work roll, each supported at its ends in bearing chock assemblies;

means for rotating the rolls;

the bearing chock assemblies of the upper work roll being urged vertically against horizontal beams located in the housings;

the bearing chock assemblies of the lower work roll being urged vertically against further horizontal beams located in the housings;

at least one of the upper and lower work rolls and its bearing chock assemblies being displaceable axially of the roll with respect to the horizontal beams, said beams being displaceable vertically with respect to the housings but being restrained against movement in their axial and lateral directions; and

means engageable with the beams adjacent their ends to apply substantially vertical bending forces thereto.

2. A rolling mill as claimed in claim 1, in which the bearing chock assemblies of the upper work roll bear against a pair of said horizontal beams and the bearing chock assemblies of the lower work roll bear against a pair of said further horizontal beams, said beams extending from one mill housing to the other.

3. A rolling mill as claimed in claim 2, in which the beams are associated with guides on the mill housings which permit the beams to be raised and lowered and which prevent movement in their axial and lateral directions.

4. A rolling mill as claimed in any preceding claim, in which the bending forces are applied to the beams by way of hydraulic rams mounted on the mill housings.

5. A rolling mill as claimed in claim 4, in which each hydraulic ram comprises a cylinder structure mounted on a mill housing and a piston extandable from the structure and engageable with the beam.

6. A rolling mill as claimed in claim 4, in which the hydraulic rams comprise a cylinder structure having a pair of pistons extendable vertically from opposite ends thereof and engageable with one of said beams and one of said further beams, respectively.

7. A rolling mill as claimed in claim 5, in which the cylinder structure has a plurality of pistons extendable therefrom, said pistons being engageable with the beam.

8. A rolling mill as claimed in claim 6, in which a plurality of pistons extend from each of the opposite ends of the cylinder structure.

9. A rolling mill as claimed in claim 1, 2 or 3, in which the bending forces are applied to a beam and to a further beam by way of hydraulic rams mounted in said beam or said further beam and engaging with the other beam.

10. A rolling mill as claimed in any preceding claim, in which each bearing chock assembly has a limited area of contact with the beams against which it is urged.

11. A rolling mill as claimed in claim 10, in which each bearing chock assembly has a pair of oppositely extending wings with each wing having an area of limited contact with a beam.

12. A rolling mill as claimed in any preceding claim, in which each work roll is backed-up by a separate back-up roll.

13. A rolling mill as claimed in claim 12, in which there is an intermediate roll between each work roll and its back-up roll, and the intermediate rolls and their bearing chock assemblies are displaceable axially.

14. A rolling mill substantially as hereinbefore described with reference to the accompanying drawings.

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